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(54) **ROBOT-BASED RACK PROCESSING SYSTEM**

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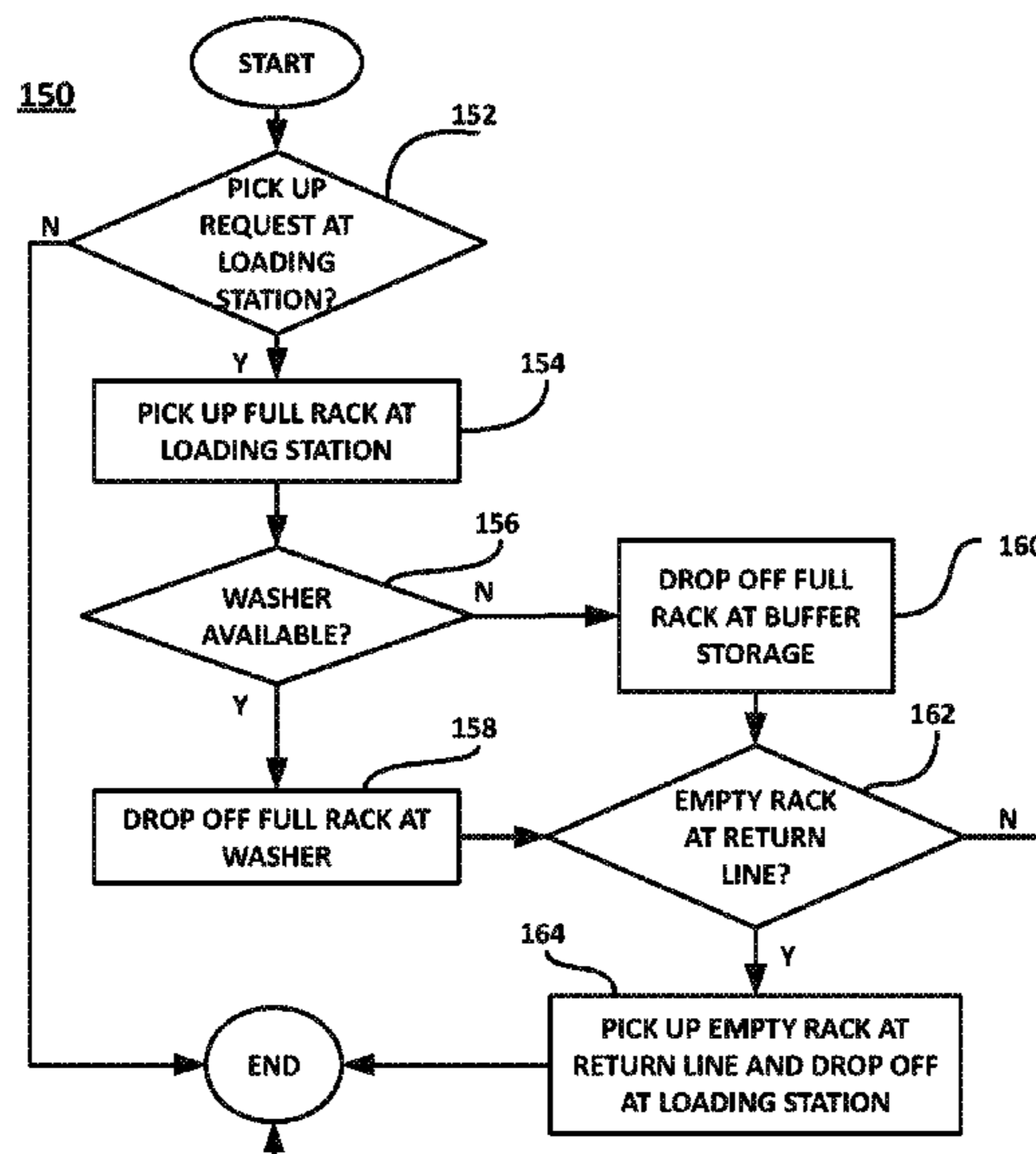
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(57) **ABSTRACT**

A robot-based system for processing racks used for transportation of articles in connection with an inactivation procedure, such as sterilization, disinfection, and decontamination. Robots are used to move full and empty racks between a plurality of a locations within soiled and clean areas of a workspace, including, but not limited to, a loading station where soiled medical instruments are loaded on the racks, washer/disinfectors for processing the medical instruments, and an unloading station where clean medical instruments are unloaded from the racks for sorting into trays.

6 Claims, 6 Drawing Sheets



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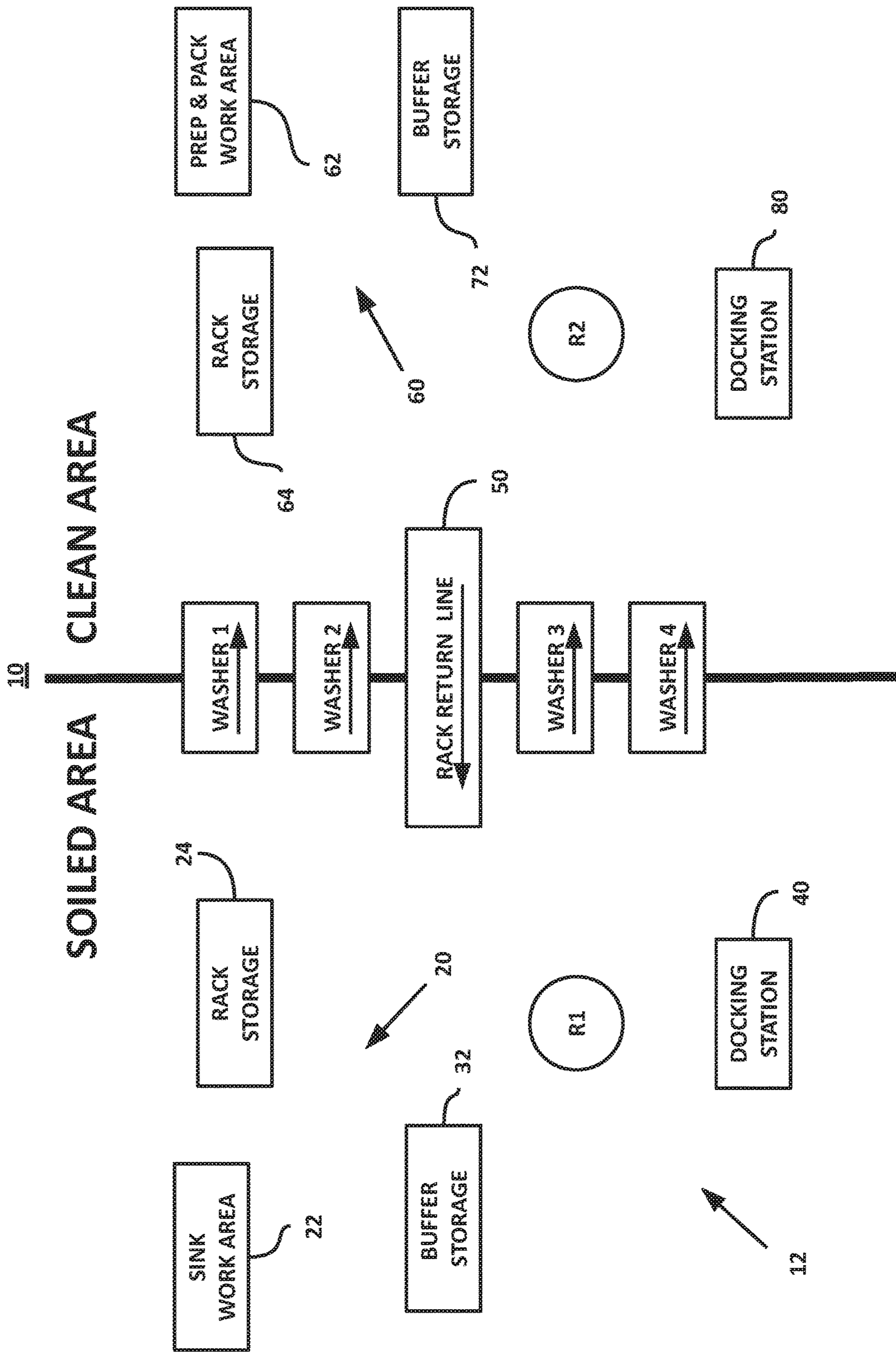


FIG. 1

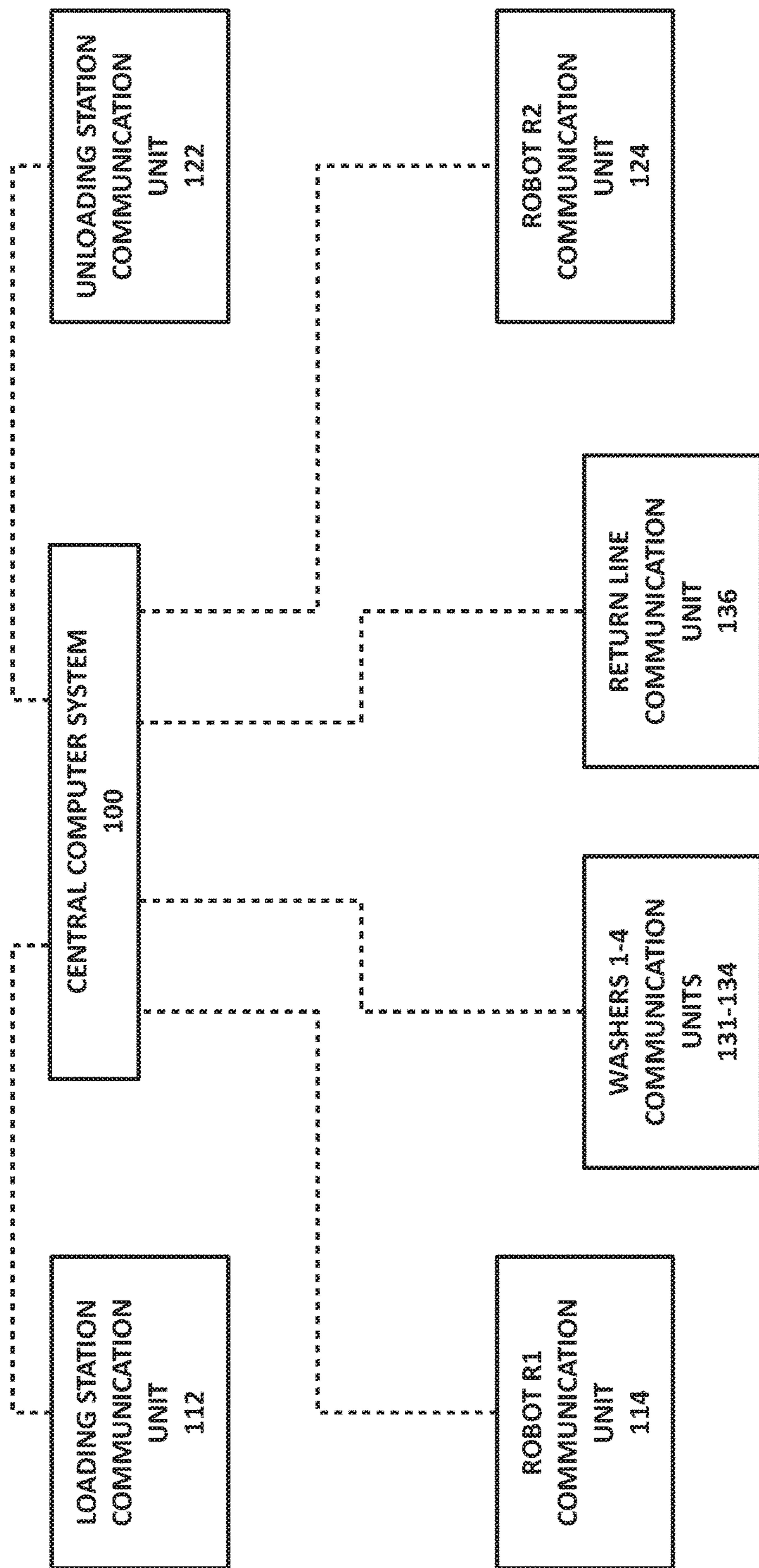


FIG. 2

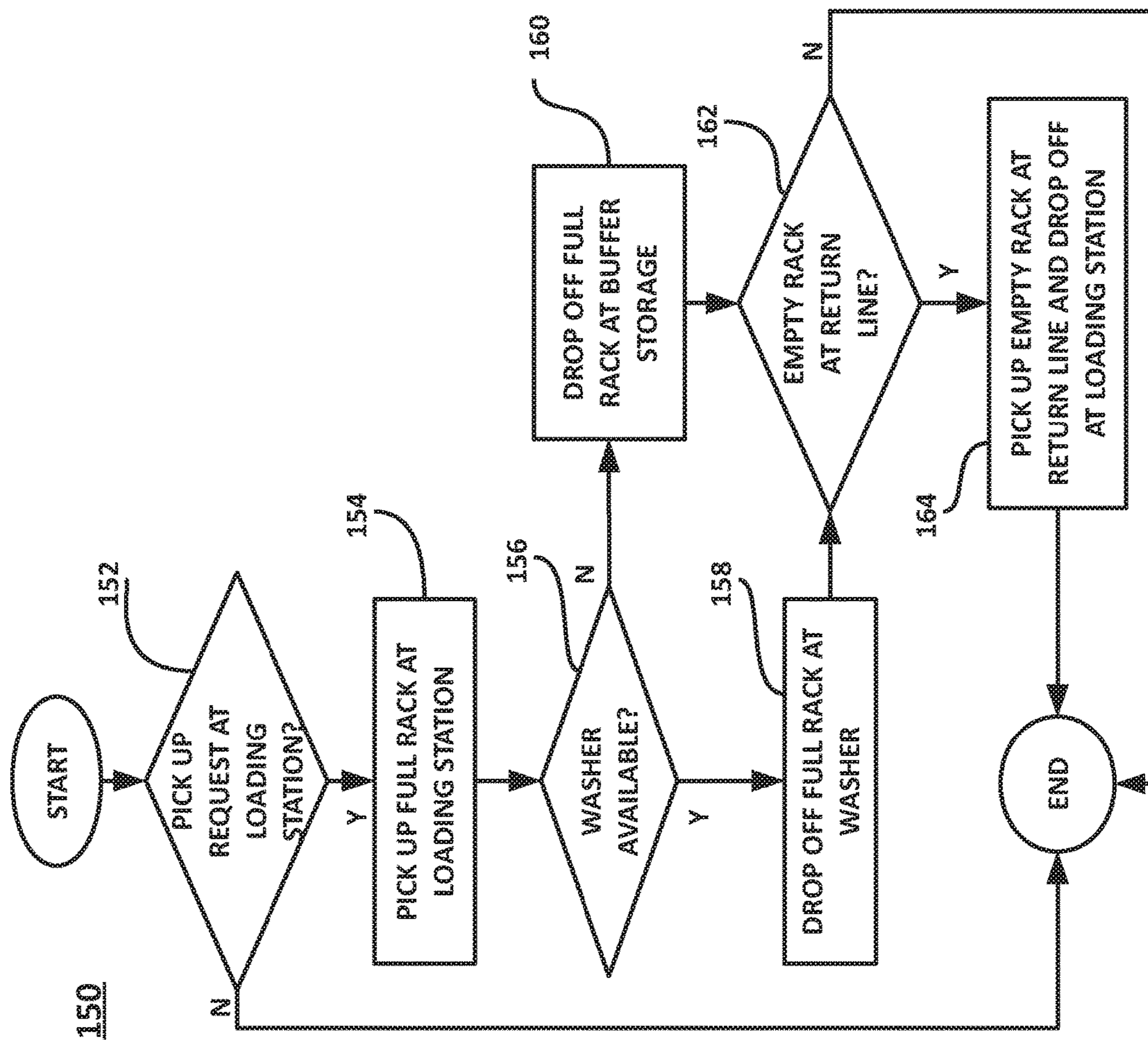


FIG. 3

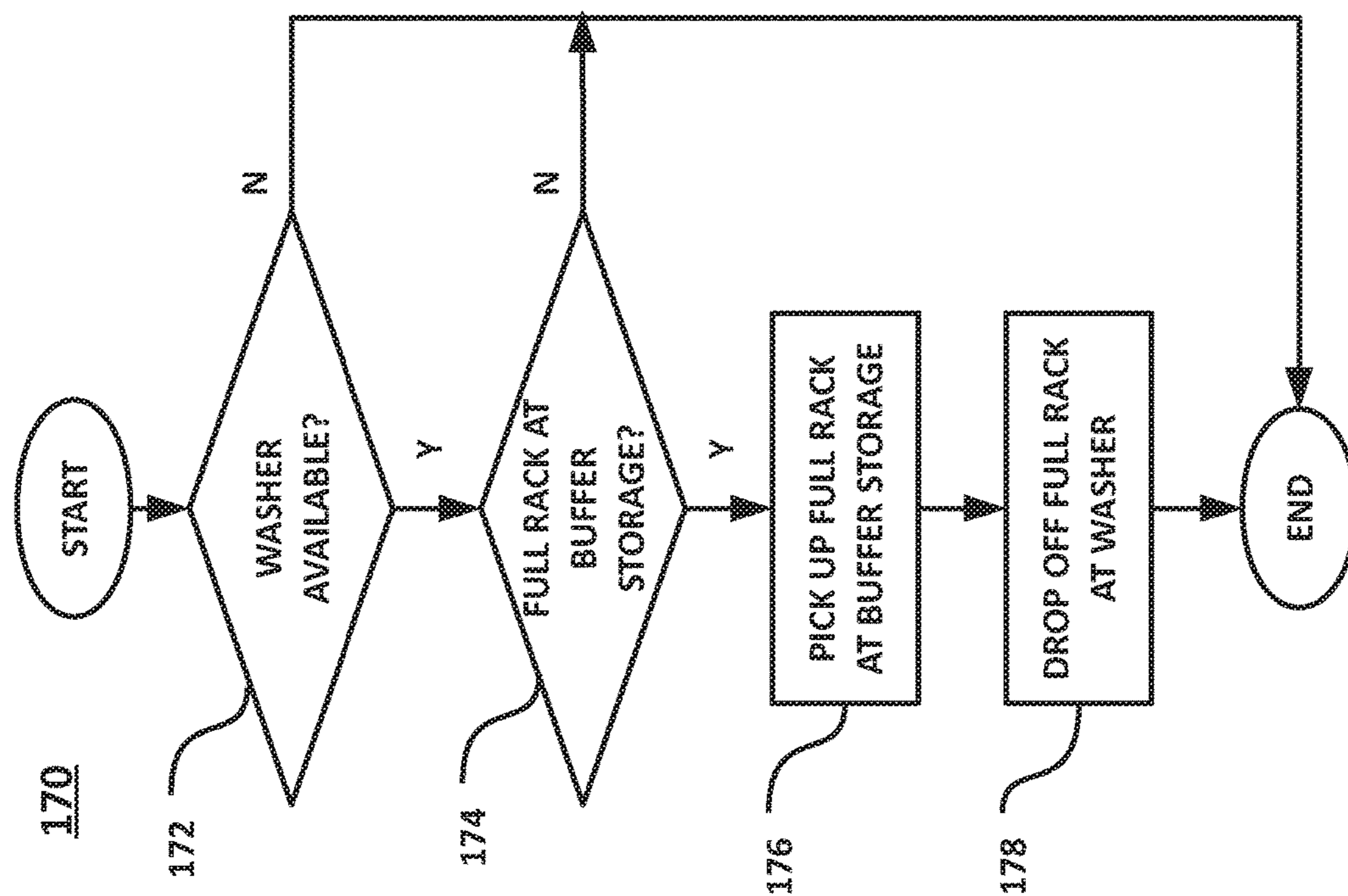


FIG. 4

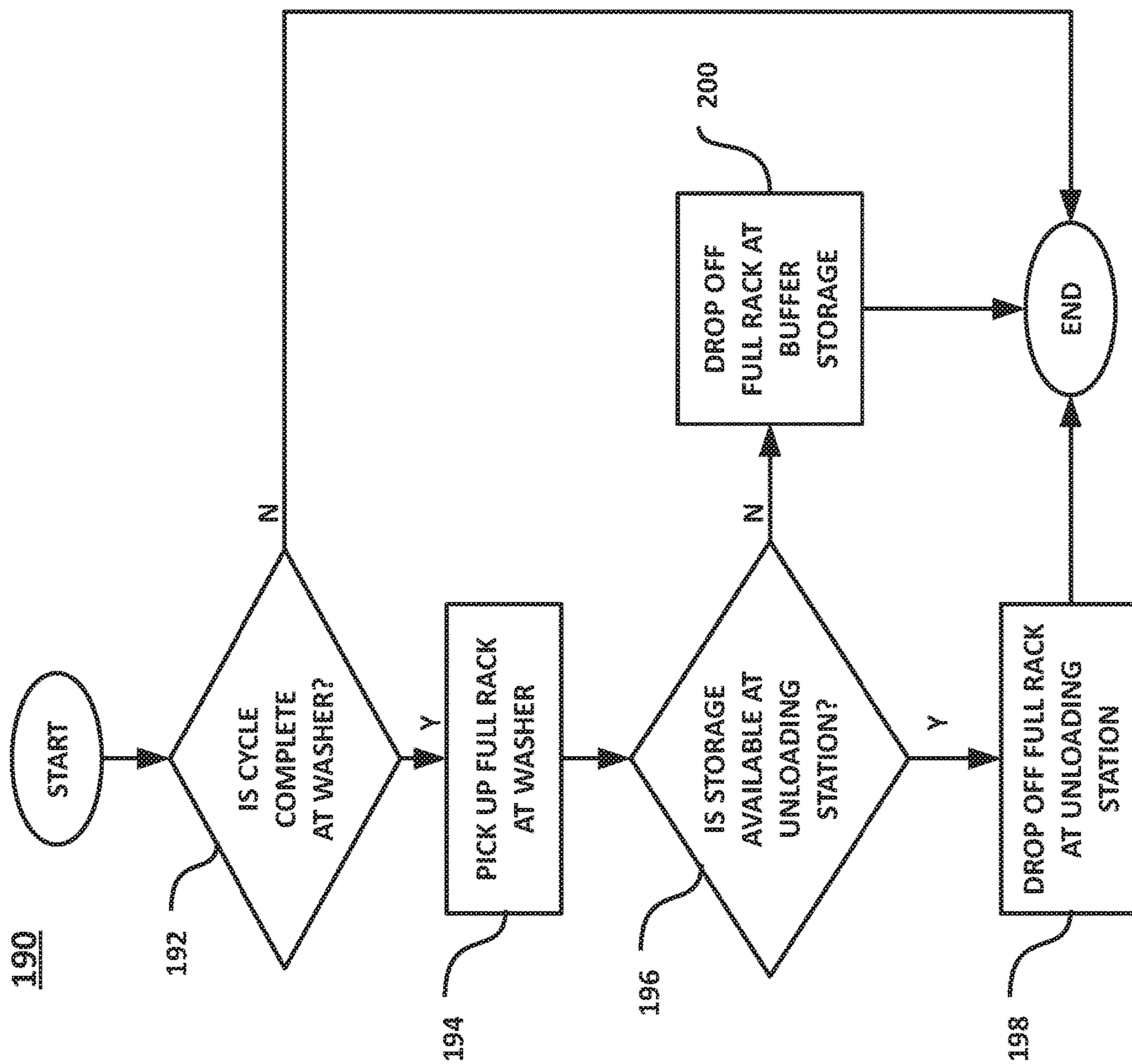


FIG. 5

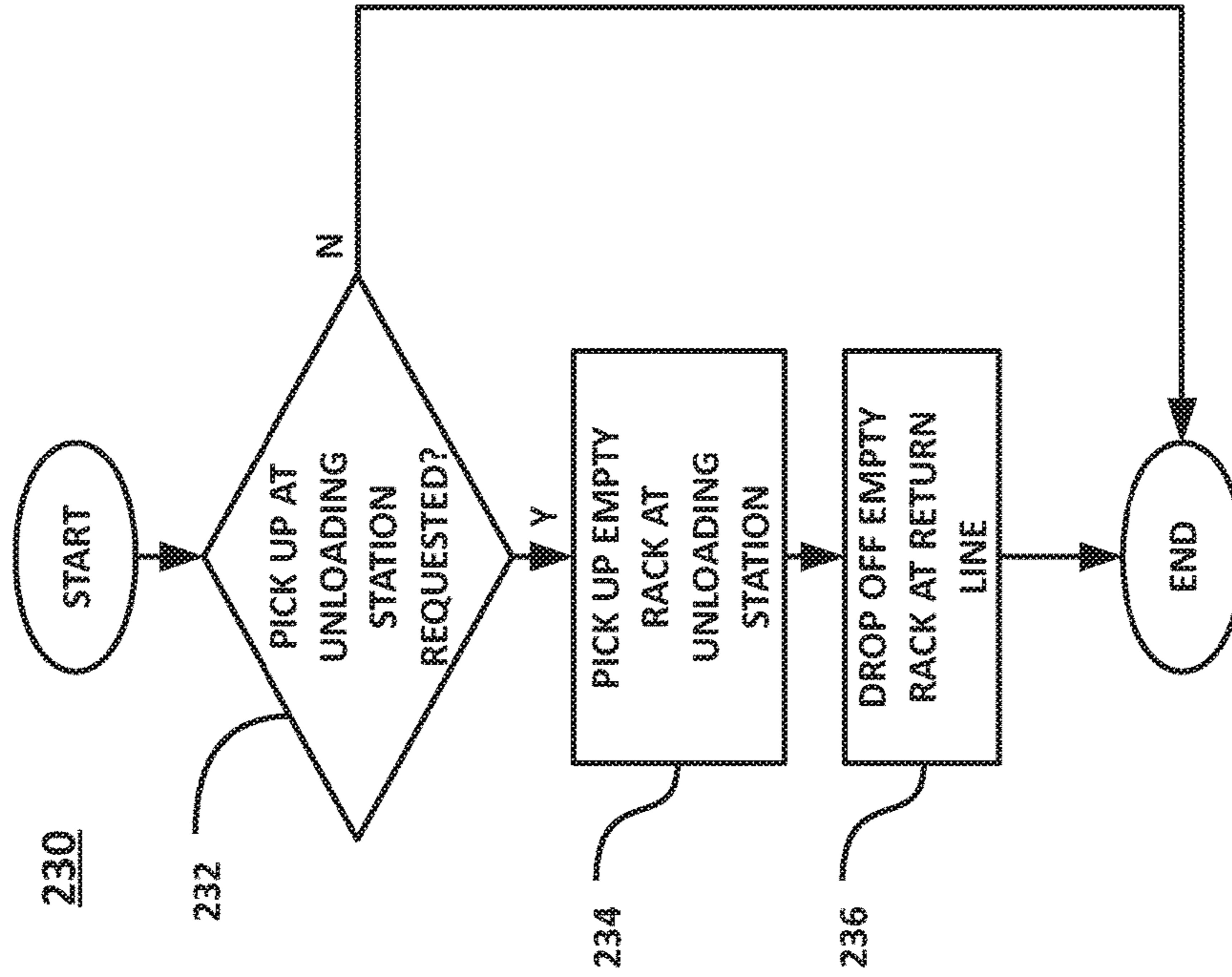


FIG. 7

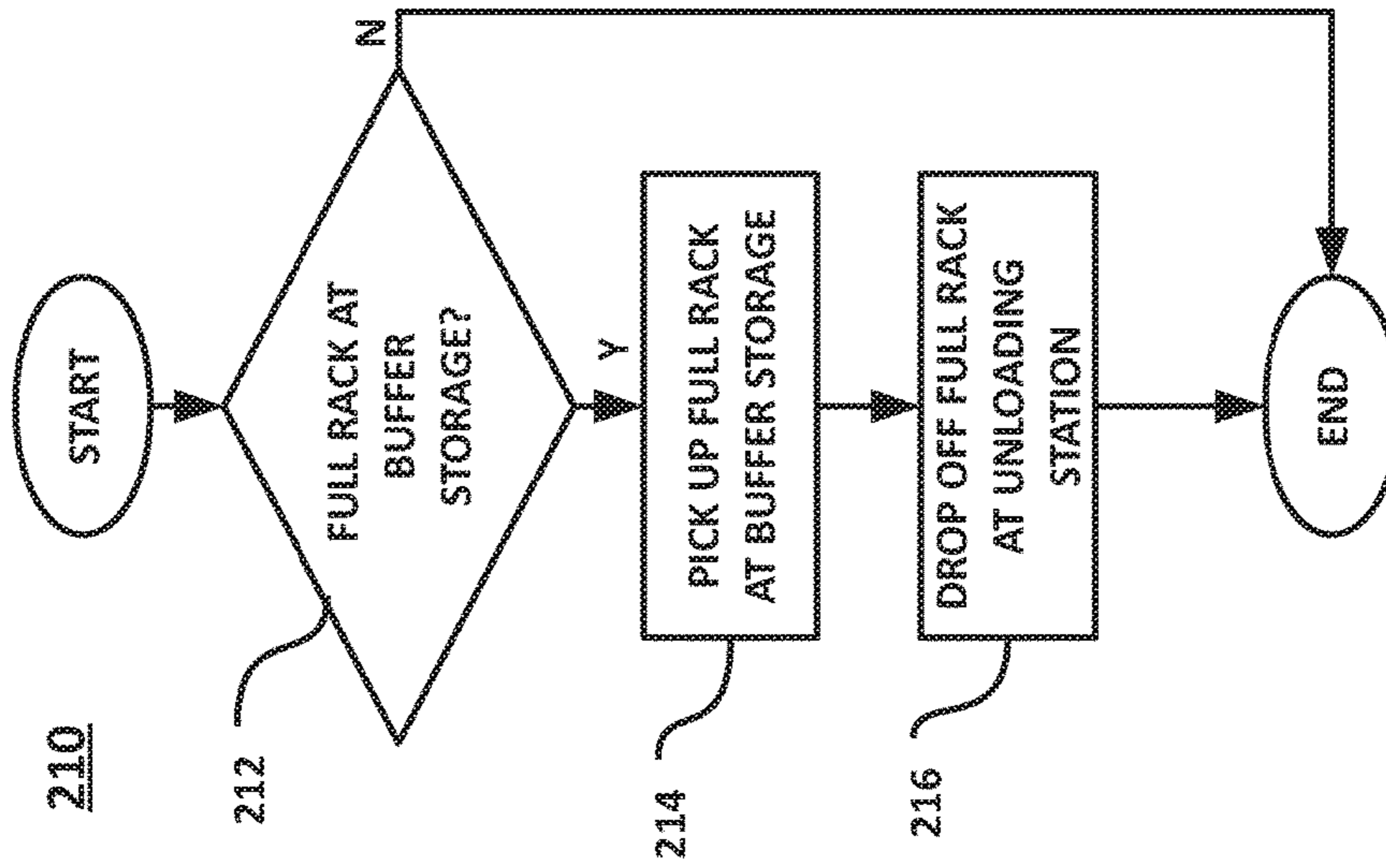


FIG. 6

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**ROBOT-BASED RACK PROCESSING
SYSTEM**

FIELD OF THE INVENTION

The present invention relates to a robot-based system for processing racks used for transportation of articles in connection with an inactivation procedure, such as a sterilization, disinfection, or decontamination process.

BACKGROUND OF THE INVENTION

In many healthcare facilities (e.g., hospitals), a central sterilization services department (CSSD) is responsible for carrying out inactivation procedures (e.g., sterilization, disinfection, and decontamination) on medical utensils, surgical instruments, and other articles found in the healthcare facility (collectively referred to herein as "medical instruments"). The workspace for a conventional CSSD is physically arranged such that there is (i) a soiled area and (ii) a clean area which is isolated from the soiled area. Soiled medical instruments are loaded into an inactivation apparatus (such as a disinfectant/washer or sterilizer) in the soiled area, and the processed medical instruments are unloaded from the inactivation apparatus in the clean area.

A rack (e.g., a manifold rack) is used to facilitate transportation and processing of the medical instruments within the workspace of the CSSD. At a first location (within the soiled area), soiled medical instruments are loaded onto a rack. Subsequently, the full rack is moved to a second location (within the soiled area) for loading into an inactivation apparatus. When the inactivation procedure is completed, the full rack is unloaded from the inactivation apparatus at a third location (within the clean area), and moved to a fourth location (within the clean area) where the medical instruments are unloaded from the rack. The empty rack is then returned to the soiled area for reuse.

In prior art rack processing systems used in connection with washers/disinfectors, it is known to use automation to load racks into the washer/disinfectant and to unload racks from the washer/disinfectant. However, in the prior art, transfer carts are used to manually transport racks between the location where racks are loaded with the soiled medical instruments and the location of an automated loader or conveyer used to load racks into the washer/disinfectant. Transfer carts are also used by operators to manually transport a rack between the location of an automated unloader or conveyer that receives a rack unloaded from the washer/disinfectant and the location where the medical instruments are unloaded from the rack.

The present invention overcomes these and other drawbacks of the prior art by providing a robot-based system for processing racks used for transportation of articles in connection with an inactivation procedure.

SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided a rack processing system for processing racks in a workspace having a soiled area and a clean area isolated from the soiled area, the rack processing system comprising: at least one inactivation apparatus for carrying out an inactivation procedure, said inactivation apparatus loaded in the soiled area and unloaded in the clean area; a first robot located in the soiled area for transporting a rack loaded with soiled medical instruments from a first location in the soiled area to the at least one inactivation apparatus; a second robot

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located in the clean area for transporting a rack loaded with clean medical instruments from the at least one inactivation apparatus to a second location in the clean area; and a central computer system for providing instructions to the first and second robots.

In accordance with another aspect of the present invention, there is provided a method for processing racks in a workspace having a soiled area and a clean area isolated from the soiled area, the method comprising: transmitting a pick up request from a loading station to a central computer system, the pick up request requesting pick up of a full rack from the loading station; and determining whether an inactivation apparatus is available for processing a rack, wherein if an inactivation apparatus is available, then transmitting instructions from the central computer system to a first robot located in the soiled area to pick up the full rack from the loading station and transport it to the available inactivation apparatus, and if the inactivation apparatus is not available, then transmitting instructions from the central computer system to the first robot to pick up the full rack from the loading station and transport it to a first buffer storage.

An advantage of the present invention is the provision of a rack processing system having greater levels of automation.

Another advantage of the present invention is the provision of a rack processing system having improved logistics.

Still another advantage of the present invention is the provision of a rack processing system that provides faster and more efficient processing.

A still further advantage of the present invention is the provision of a rack processing system that can reduce injury risk to the operator.

Yet another advantage of the present invention is the provision of a rack processing system that integrates use of autonomously guided vehicles for transport of racks within a workspace.

These and other advantages will become apparent from the following description of illustrated embodiments taken together with the accompanying drawings and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may take physical form in certain parts and arrangement of parts, an embodiment of which will be described in detail in the specification and illustrated in the accompanying drawings which form a part hereof, and wherein:

FIG. 1 is a block diagram of a workspace for a robot-based rack processing system, according to an embodiment of the present invention;

FIG. 2 is a block diagram of a central computer system of the rack processing system as linked to several associated communication units, according to an embodiment of the present invention;

FIG. 3 is a flow diagram illustrating a pre-wash pick up routine, according to an embodiment of the present invention;

FIG. 4 is a flow diagram illustrating a washer load routine, according to an embodiment of the present invention;

FIG. 5 is a flow diagram illustrating a washer unload routine, according to an embodiment of the present invention;

FIG. 6 is a flow diagram illustrating a buffer storage unload routine, according to an embodiment of the present invention; and

FIG. 7 is a flow diagram illustrating an unloading station pick up routine, according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings wherein the showings are for the purposes of illustrating an embodiment of the present invention only and not for the purposes of limiting same, FIG. 1 shows a block diagram of a workspace 10 for a robot-based rack processing system 12, according to an embodiment of the present invention. Workspace 10 is divided into a soiled area and a clean area that is isolated from the clean area by a wall or other barrier.

It should be appreciated that the present invention is described herein with reference to a disinfection procedure that uses washer/disinfectors as the disinfection apparatus, as will be described below. However, this illustrated embodiment of the present invention is not intended to limit same. Thus, it is contemplated that other types of inactivation apparatus may be substituted for the washer/disinfectors of the illustrated embodiment, including, but not limited to, a sterilization apparatus. Moreover, the operations described herein as pre-wash and post-wash may be other types of processing steps taken before and after a different inactivation procedure (e.g., sterilization).

In the soiled area of workspace 10, system 12 is generally comprised of a loading station 20, a buffer storage 32, a docking station 40, and a robot R1. Loading station 20 includes a sink work area 22 and a rack storage 24. In the clean area of workspace 10, system 12 is generally comprised of an unloading station 60, a buffer storage 72, a docking station 80, and a robot R2. Unloading station 60 includes a preparation and packaging ("prep & pack") work area 62 and a rack storage 64.

System 12 also includes one or more inactivation apparatus and a rack return line 50. A loading side of the inactivation apparatus is located in the soiled area, and an unloading side of the inactivation apparatus is located in the clean area. In the illustrated embodiment, the inactivation apparatus takes the form of washers 1-4, which are conventional washer/disinfectors which both wash and disinfect medical instruments. For example, the washer/disinfectors may be Reliance® or AMSCO® brand washer/disinfectors from STERIS. A loading side of the rack return line 50 is located in the clean area and an unloading side of rack return line 50 is located in the soiled area. In the illustrated embodiment, rack return line 50 takes the form of a conventional conveyor system.

Loading station 20, buffer storage 32, docking station 40, washers 1-4, and rack return line 50 are locations between robot R1 moves to deliver and retrieve racks, as will be described in detail below. It is contemplated that robot R1 may travel to additional locations within the soiled area that are not shown in the illustrated embodiment.

Referring now to the soiled area of workspace 10, loading station 20 is a location where an operator performs pre-wash operations to process soiled medical instruments. Sink work area 22 includes one or more washing sinks. Rack storage 24 is a structure for storing (i) empty racks that are to be filled by an operator with pre-washed medical instruments and (ii) storing racks that have been filled by an operator with pre-washed medical instruments to be processed by a washer. In the illustrated embodiment, rack storage 24 may take the form of one or more tables located proximate to washing sinks in sink work area 22. Buffer storage 32

provides temporary storage for full racks that are awaiting loading into a washer. In the illustrated embodiment, buffer storage 32 may take the form of one or more tables or shelves.

In the illustrated embodiment, robot R1 is an autonomous guided vehicle (AGV), such as the Adept Lynx™ self-navigating autonomous indoor vehicle (AIV) from Omron Adept Technologies, Inc. The Adept Lynx™ includes a controller, a user interface (e.g., touchscreen interface), an electric motor locomotion system, an on-board power supply (22-29 VDC power pack), power management, I/O for wireless communication, sensors, lasers support, and a programmable navigation system for navigating through the use of a stored digital map. Robot R1 can use the digital map to avoid traveling into regions within workspace 10, such as a region proximate to a washer undergoing maintenance. For example, Robot R1 can be programmed to prevent entry into certain prohibited regions within workspace 10.

In the illustrated embodiment, robot R1 may be adapted to include a computer controlled payload handling system to facilitate the handling, loading, and unloading of racks from robot R1. The handling system includes a support platform for supporting a rack on robot R1; an alignment system for precise alignment of robot R1 at a target location; a lift system for adjusting the vertical position of the support platform; and a pusher/puller system for "pushing" a rack off of the support platform and for "pulling" a rack onto the support platform. The lift system is comprised of a motor (e.g., servomotor), a scissor lift assembly, and a limit switch. The pusher/puller system is comprised of a motor (e.g., servomotor), an actuator (e.g., a solenoid), and a limit switch. The alignment system includes one or more proximity sensors and one or more lasers.

The handling system operates in the following manner. The laser is used to detect the center position of a goal (e.g., the loading-side or unloading-side opening of a washer) using a target. The target may take the form of a vertical narrow reflector strip that reflects the laser beam while robot R1 is turning a few degrees for a laser scan. Robot R1 turns in order to accurately align with the center position of the goal. The robot then moves forward toward the goal until the proximity sensors detect contact with the surface of the goal. Once robot R1 has reached the goal, the height of the support platform is adjusted by the lift system using the same laser beam. In this regard, the lift system increases the height of the support platform, until it detected that the laser beam has reached the top of the reflector strip.

In accordance with an embodiment of the present invention, the support platform includes a sensor and a plunger. The plunger holds the rack in place during movement of the robot, and the sensor detects whether the rack has been successfully loaded onto the support platform.

Robot R1 may also include a fluid collection system that includes a fluid collection reservoir (e.g., drip pan) and an electronically actuated drain valve. The fluid collection reservoir collects water that drips off the racks transported by robot R1. For example, water or condensate may be on the surface of the racks as a result of the washing/disinfection process. The drain valve is opened to empty the fluid collection reservoir. The fluid collection system may also include a level detector for detecting the fluid level within the fluid collection reservoir. The level detector alerts the control system of robot R1 that the fluid collection reservoir needs to be purged. This information can also be communicated to a central computer system 100, described below.

Docking station 40 serves as a recharging station that provides power for recharging a battery of robot R1. In the

illustrated embodiment, docking station **40** may also include a floor drain or a collection vessel for receiving fluid emptied from the fluid collection reservoir of robot R1.

Referring now to the clean area of workspace **10**, unloading station **60** is a location where an operator performs post-wash operations. At prep & pack work area **62**, an operator unloads clean medical instruments from a rack, inspects the medical instruments, and sort the medical instruments into organized trays. The organized trays may be stored in a cooling storage unit (not shown). Rack storage **64** is a structure for storing (i) full racks that have been removed from a washer and are to be processed by an operator and (ii) racks that have been emptied by an operator and are awaiting return to the soiled area. In the illustrated embodiment, rack storage **64** may take the form of one or more tables located proximate to prep & pack work area **62**. Buffer storage **72** provides temporary storage for full racks that have been removed from a washer. In the illustrated embodiment, buffer storage **32** may take the form of one or more tables or shelves.

Unloading station **60**, buffer storage **72**, docking station **80**, washers **1-4**, and rack return line **50** are locations between robot R2 moves to deliver and retrieve racks, as will be described in detail below. It is contemplated that robot R2 may travel to additional locations within the clean area that are not shown in the illustrated embodiment.

Robot R2 is substantially the same as robot R1 described above. Likewise, docking station **80** is substantially the same as docking station **40** described above.

It should be appreciated that while the illustrated embodiment of the present invention has only a single robot in the soiled and clean areas, it is contemplated that a more than one robot may be located in the soiled and clean areas.

System **12** also includes central computer system **100**, as shown in FIG. **2**. Communication units located within the soiled and clean areas allow for bi-directional data communication with central computer system **100**. Communication between central computer system **100** and the communication units may include the use wired and/or wireless communication systems (e.g., Ethernet, TCP/IP, Wi-Fi, etc.).

In the illustrated embodiment, loading station communication unit **112** and unloading station communication unit **122** include a user interface for an operator to request a rack pick up or delivery. For example, a tablet computer device may serve as communication units **112** and **122**. Robot R1 includes communication unit **114** and robot R2 includes communication unit **124**. Washers **1-4** include communication units **131-134** to provide status information to the central computer system **100** (e.g., ready for loading, busy, and cleaning cycle complete) and to receive instructions from central computer system **100** (e.g., open door at soiled-side for loading, and open door at clean-side for unloading), and rack return line **50** includes communication unit **136** to provide status information (e.g., rack awaiting pick up at soiled-side).

In an embodiment of the present invention, the racks of system **12** may include a machine-readable code (e.g., bar code or RFID tag) that can be scanned. The machine-readable code can uniquely identify each rack and/or identify a rack type (e.g., 2-level rack, 5-level rack, multi-function rack, special purpose rack, etc.). Each washer **1-4** may include a scanner to scan each rack that is loaded into the washer. The information about the scanned rack is communicated by washers **1-4** (via communication units **131-134**) to central computer system **100**. Information about the scanned rack can be used by the washer to determine a suitable cleaning cycle for the rack. Rack return line **50** may

also include a scanner to scan each rack that is returned from the clean area to the soiled area. Information about each rack is communicated by return line **50** (via communication unit **136**) to central computer system **100**. Accordingly, central computer system **100** can prioritize a rack pick up at return line **50** (soiled area) based upon a requested rack type. It is also contemplated that robots R1 and R2 may include scanners to scan racks, and provide information about the racks to central computer system **100**.

Basic operation of robot-based rack processing system **10**, according to an embodiment of the present invention, will now be summarized in connection with rack processing in the soiled and clean areas.

Soiled Area

- 1) An operator at loading station **20** sends instructions to central computer system **100** requesting pick up of a full rack loading station **20**, and delivery of an empty rack to loading station **20**.
- 2) Robot R1 receives instructions from central computer system **100** to pick up the full rack at loading station **20**, and delivery the full rack to an available washer. If no washers are currently available, then robot R1 delivers the full rack to buffer storage **32** for temporary storage until a washer becomes available.
- 3) Robot R1 receives instructions from central computer system **100** to pick up an empty rack from the rack return line **50** and deliver the empty rack to loading station **20**.

Clean Area

- 1) An operator at unloading station **60** sends instructions to central computer system **100** requesting pick up of an empty rack at unloading station **60**, and delivery of a (clean) full rack to unloading station **60**.
- 2) Robot R2 receives instructions from central computer system **100** to pick up an empty rack from unloading station **60** and deliver the empty rack to rack return line **50** for return to the soiled area of workspace **10**.
- 3) Robot R2 receives instructions from central computer system **100** to pick up the (clean) full rack at one of the washers, and deliver the full rack to unloading station **60**. If no space is available at unloading station **60**, then robot R2 delivers the full rack to buffer storage **72** for temporary storage until space becomes available at unloading station **60**.

Detailed operation of robot-based rack processing system **12** will now be described with reference to FIGS. **3-7**, which respectively illustrate flow diagrams for a pre-wash pick up routine **150**, a washer load routine **170**, a washer unload routine **190**, a buffer storage unload routine **210**, and an unloading station pick up routine **230**.

FIG. **3** shows a flow diagram for pre-wash pick up routine **150** (soiled area). This routine involves pick up of a full rack from loading station **20**, drop off of the full rack at an available washer or at buffer storage **32**, and drop off of an empty rack (returned from the clean area) at loading station **20**. First, it is determined whether an operator at loading station **20** has made a pickup request by sending instructions to central computer system **100** (step **152**). If a pickup request has been made, then central computer system **100** sends instructions to robot R1 to pick up a full rack at loading station **20** (step **154**). The computer system **100** determines whether any washers are available (step **156**). If it is determined that no washers are available, then central computer system **100** sends instructions to robot R1 to drop off the full rack at buffer storage **32**. If it is determined that a washer is available, then central computer system **100** sends instructions to robot R1 to drop off the full rack at the

available washer (step 158). Following the step of dropping off the full rack at a washer (step 158) or the step of dropping off the full rack at buffer storage 32 (step 160), central computer system 100 determines whether there is an empty rack ready for pick up at return line 50 to replace the full rack that was retrieved from loading station 20 (step 162). If it is determined that there is an empty rack awaiting pick up at return line 50, then central computer system 100 sends instructions to robot R1 to pick up the empty rack at return line 50 and drop it off at loading station 20 (step 164). If it is determined that there is no empty rack at return line 50, then the pre-wash pick up routine ends.

In one embodiment of the present invention, central computer system 100 randomly selects an available washer for loading with a full rack. In an alternative embodiment, central computer system 100 selects a washer that is most suitable for the type of rack.

FIG. 4 shows a flow diagram for the washer load routine 170 (soiled area). This routine involves pick up of full rack stored at buffer storage 32 and drop off at an available washer. Central computer system 100 determines whether a washer is available (step 172). If no washer is available, then washer load routine 170 ends. If a washer is available, then it is determined whether there is a full rack awaiting pick up at buffer storage 32 (step 174). If there is no full rack awaiting pick up at buffer storage 32, then washer load routine 170 ends. If there is a full rack awaiting pickup a buffer storage 32, then central computer system 100 sends instructions to robot R1 to pick up a full rack at buffer storage 32 (step 176) and drop off the full rack at the available washer (step 178).

FIG. 5 shows a flow diagram for the washer unload routine 170 (clean area). This routine involves pick up of a full rack at a washer and drop off of the full rack at unloading station 60 or at buffer storage 72. Central computer system 100 determines if a cleaning cycle is completed at one of the washers 1-4 (step 192). If none of the washers are ready for a pick up, then the washer unload routine 190 ends. If one of the washers 1-4 is ready for a pickup, then central computer system 100 sends instructions to robot R2 to pick up a full rack at the washer (step 194). Central computer system 100 determines whether any storage is available at unloading station 60. If storage is available, then central computer system 100 sends instructions to robot R2 to drop off the full rack at unloading station 60. If no storage is available at unloading station 60, then central computer system 100 sends instructions to robot R2 to drop off the full rack at buffer storage 72 (step 200).

FIG. 6 shows a flow diagram for the buffer storage unload routine 210 (clean area). This routine involves pick up of a full rack at buffer storage 72 and drop off of the full rack at unloading station 60. Central computer system 100 determines if a full rack is awaiting pickup at buffer storage 72 (step 212). If no full rack is awaiting pickup, then buffer storage unload routine 210 ends. If a full rack is awaiting pickup, then central computer system 100 sends instructions to robot R2 to pick up the full rack at buffer storage 72 (step 214) and drop off the full rack at unloading station 60 (step 216).

FIG. 7 shows a flow diagram for the unloading station pick up routine 230 (clean area). This routine involves pick up of an empty rack at unloading station 60 and drop off of the empty rack at return line 50. Central computer system 100 determines whether an operator has made a request for a pickup at unloading station 60 (step 232). If a pickup request has been made, then central computer system 100 sends instructions to robot R2 to pick up the empty rack at

unloading station 60 (step 234) and drop off the empty rack at return line 50 (step 236). If no pickup request has been made by an operator, then unloading station pick up routine 230 ends.

In one embodiment of the present invention, the instructions sent to central computer system 100 by the operator to request pick up of a full rack at loading station 20 may include (i) a priority level to identify a priority for the requested pick up of the full rack, and/or (ii) a rack-type to identify the type of empty rack that is to be delivered to loading station 20 to replace the full rack being picked up. In one embodiment of the present invention, priority levels are represented by a value from 1 to 100, where 1 is normal priority and 100 is highest priority.

It is also contemplated that a priority level and/or a rack-type may be determined by central computer system 100 for complete processing by system 12. For example, priority level and rack-type may be determined according to a list of surgery requests entered into central computer system 100. Therefore, depending on the type of surgeries scheduled for the day, certain medical instruments may need to be processed by the washers faster than others in order to be available for use in the next scheduled surgery. This priority level selection allows a high priority level to be associated with a particular rack type.

The foregoing describes specific embodiment of the present invention. It should be appreciated that these embodiments are described for purposes of illustration only, and that numerous alterations and modifications may be practiced by those skilled in the art without departing from the spirit and scope of the invention. It is intended that all such modifications and alterations be included insofar as they come within the scope of the invention as claimed or the equivalents thereof.

Other modifications and alterations will occur to others upon their reading and understanding of the specification. It is intended that all such modifications and alterations be included insofar as they come within the scope of the invention as claimed or the equivalents thereof.

Having described the invention, the following is claimed:

1. A rack processing system for processing racks in a workspace having a soiled area and a clean area isolated from the soiled area, the rack processing system comprising:
 - a loading station in the soiled area for loading racks with soiled medical instruments;
 - a first buffer storage in the soiled area for storing racks loaded with soiled medical instruments;
 - at least one inactivation apparatus for carrying out an inactivation procedure on racks loaded with soiled medical instruments, said inactivation apparatus is a washer/disinfector or a sterilizer having a loading side in the soiled area and an unloading side in the clean area;
 - a rack return line including a conveyer for returning racks from the clean area to the soiled area, said rack return line having a loading side in the clean area and an unloading side in the soiled area;
 - a first robot located in the soiled area for transporting racks between a plurality of locations that include: (i) the loading station, (ii) the first buffer storage, (iii) the inactivation apparatus, and (iv) the rack return line;
 - an unloading station in the clean area for unloading medical instruments from racks processed by the inactivation apparatus;
 - a second buffer storage in the clean area for storing racks loaded with medical instruments processed by the inactivation apparatus;

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a second robot located in the clean area for transporting racks between a plurality of locations that include: (i) the inactivation apparatus, (ii) the unloading station, (iii) the second buffer storage, and (iv) the rack return line; and

a central computer system for providing instructions to the first and second robots, the central computer system programmed to:

(a) receive a pick up request from the loading station requesting pick up of a rack from the loading station, and determine whether an inactivation apparatus is available for processing the rack, wherein

if the inactivation apparatus is available, the central computer system programmed to transmit instructions to the first robot to pick up the rack from the loading station and transport the rack to the inactivation apparatus that is available, and

if the inactivation apparatus is not available, the central computer system programmed to transmit instructions to the first robot to pick up the rack from the loading station and transport the rack to the first buffer storage; and

(b) receive status information indicating whether the inactivation apparatus has completed a processing cycle, and determine whether storage is available at the unloading station, wherein

if the processing cycle of the inactivation apparatus is complete and storage is available at the unloading station, then the central computer system programmed to transmit instructions from the central computer system to the second robot to pick up the rack from the inactivation apparatus and transport the rack to the unloading station, and

if the processing cycle of the inactivation apparatus is complete and storage is not available at the unloading station, then the central computer system programmed to transmit instructions from the central computer system to the second robot to pick up the

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rack from the inactivation apparatus and transport the rack to the second buffer storage.

2. The rack processing system of claim 1, wherein the system further comprises a first docking station in the soiled area for recharging the first robot.

3. The rack processing system of claim 1, wherein the system further comprises a second docking station in the clean area for recharging the second robot.

4. The rack processing system of claim 1, wherein the central computer system is programmed to determine whether an inactivation apparatus is available for processing a rack and whether a rack is located at the first buffer storage, wherein

if the inactivation apparatus is determined to be available and the rack is located at the first buffer storage, said central computer system programmed to transmit instructions to the first robot to pick up the rack from the first buffer storage and transport to the available inactivation apparatus.

5. The rack processing system of claim 1, wherein the central computer system is programmed to determine whether a full rack is located at a second buffer storage, wherein if the full rack is located at the second buffer storage, said central computer system programmed to transmit instructions to the second robot to pick up the full rack from the second buffer storage and transport the full rack to the unloading station.

6. The rack processing system of claim 1, wherein the central computer system is programmed to determine whether a request has been received from the unloading station for a pick up of an empty rack at the unloading station, wherein if the request has been received from the unloading station, said central computer system programmed to transmit instructions to the second robot to pick up the empty rack at the unloading station and transport the empty rack to the return line for returning the empty rack to the soiled area.

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